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moving towards the north-west, and therefore nearly perpendicularly to our line of sight. By 10 A.M. the conditions for the formation of the water-spouts, namely, the long axis extending down from the clouds, had become very favorable; so that from 9.30 until 10.15 there was a continued succession of such spouts, forming and disappearing in this portion of the horizon. At one time as many as five and seven were visible simultaneously; and the total number that formed and disappeared was estimated at about thirty by some, but at about twenty by myself. The first ones formed were at a distance from us estimated at about four miles; the last ones, at a distance of two or three miles. As the squall grew in dimensions and approached us, it was hoped that spouts would be formed much nearer; and in fact one was observed endeavoring to form in a mass of rain, at a distance of scarcely a quarter of a mile on our starboard bow. A number of drawings of these phenomena were made, and some photographs were taken. The latter, however, are not considered very successful, owing to the insufficient contrast. Among the features noted in these water-spouts, which will, I think, deserve to be ranked as general phenomena for all such spouts, are the following:—

1. The whirling motion of all the spouts took place in the same direction, so far as could be judged, and was that ordinarily called "counter clock-wise."

2. The general motion of the water-spouts as a whole was from left to right, or from the south-east toward the north-west, and therefore counter clock-wise, considered as a partial rotation round the centre of the rain-squall.

3. As this rain-squall was essentially a part of the formation of a cumulus-cloud out of a mass of what would otherwise have been called low scud, and as no water-spouts, or any tendency to the formation of such, were seen on the other side of the cloud after it had overtaken us, as it did at 10.30, I conclude that the formation of the water-spout requires a special upward ascending current due to a special buoyancy in one portion of the cloud; and, other circumstances being the same, such buoyancy must generally be found, as in this case, on the sunny side of the cloud, and is due largely to the action of the sun's heat on the surface of the cloud, combined of course with the buoyancy of the ascending cloud masses. As regards the individual tornadoes or water-spouts, it is very evident that a less rapid whirl was required to form the little saucer-shaped mass of spray at the ocean's surface than was required to form the axial cloud that reached down from above. There were, I think, more cases in which the spray appeared first, before the cloudy axis was visible, than the reverse cases; but there was nothing to show that the ascending movement started at the ocean's surface, and carried the sea-water upward into the cloud. On the contrary, all the details of the phenomena showed that the spray carried up from the surface of the sea attained only a height of perhaps a hundred feet, and was then thrown out, and descended from the rim of the saucer. In some cases the axial cloud apparently descended into, and was lost sight of in, the lower spray, but its appearance was such that it was always possible to distinguish it from the spray. The axial cloud invariably began its formation at the lower surface of the general cloud, and stretched downward by spasmodic efforts, gradually increasing its length until it perhaps reached the spray, and then began retreating, forming and re-forming several times, until finally either a permanently steady, tubular cloud was formed, which would continue in sight, bending and swirling; about for several minutes, or, as in many cases, after several efforts the whirl broke up, and no permanent tube was formed. When the cloud was about to shoot down to a considerably lower level than it had hitherto attained, the shooting was generally preceded by the appearance of an exceedingly fine axial line; and when the tubular cloud shot down, as seen by the distant observer, I should say that this apparent descent was merely the sudden expansion to a visible diameter of the fine line that had just preceded it. The appearance of this fine line was very similar to that of the sting of a bee protruding from its sheath; and frequently I saw this line shoot down and disappear a number of times before the rapid whirl was finally able to produce an axial cloud of permanent size. In many cases

the axial cloud itself showed a fine line down its centre, the cloud itself being whitish; while the central line was either dark or bright, depending upon the background against which it was seen. This agrees perfectly with the accepted theory of the formation of the spouts, according to which the long narrow cloud is not a solid mass of cloudy material, but rather a hollow cylinder; so that when one looks through it the central portion is much more transparent than the edges.

At numerous points, from the general cloud under which the water-spouts were formed, there were descending showers of rain; and scud, from which rain descended, afterwards formed between us and the tornadoes, and finally again off the port side of the vessel; so that by 10.20 we were enveloped in a heavy rain, with the wind from the south-east or starboard side. This continued ten or fifteen minutes, after which it slackened up. In hopes that we might get near enough to the whirl that surrounds the spout, and experience an appreciable depression of the barometer, I carried an aneroid in my hand; but in no case was I able to see that it was affected by any or all of the spouts. The barometer at 9 A.M. had read 30.12; at 9.35 it read 30.08; at 10.20, after the rain-squall had struck us, the pressure rose to 30.20, and at 1 P.M. had sunk again to 30.18. These fluctuations are those that attend ordinary rain-squalls, and have, I suppose, no connection with the water-spouts as such. It was not to be expected that the barometer would fall except within the whirling wind, and possibly within a hundred feet of the axes of the water-spouts.

It has frequently been supposed that the discharge of a cannon will break up a water-spout. On the present occasion, it so happened that a six-pounder was ordered to be discharged in order to clean it out; and this took place in the midst of the display of water-spouts, which were then three or four miles distant. The discharge of the cannon was followed within a few seconds by the breaking-up of one of the spouts; but others remained, and several others were formed a few minutes afterwards, so that the breaking-up of the one can only be considered an accidental coincidence; nor is there to my mind any conceivable reason why the discharge of a cannon, at a long distance from a spout, or even the firing of a cannon-ball through the spout, should be considered likely to have any appreciable influence on the great mass of revolving air.

The general discussion of the mechanism of a water-spout has been so well given by Ferrel in his newest work, "A Popular Treatise on the Winds" (New York, 1889), that I need only say that every thing observed by us on the 22d of October fully confirmed the views therein set forth by him.

On the next day, the 23d, about 8.30 A.M., the clouds looked favorable for a repetition of the water-spout phenomena, and beautiful mammiform clouds were indeed seen developing into the axial clouds of water-spouts. One of these lasted over twenty minutes, but did not reach any considerable distance down toward the sea; nor was any whirl of ocean spray to be seen beneath it.

Of all the spouts seen on the 22d, the largest appeared to have a horizontal diameter of about one-tenth its vertical height. This one also lasted the longest, and, after breaking up, was apparently followed by rain to a greater extent than in the other spouts. The narrowest of these spouts had an apparent diameter of about one hundredth part of its height. The general height of the tops of the spouts was pretty uniform, like that of the scud to which they belonged, and was, I should estimate, about twelve hundred feet.

AMENDED ORTHOGRAPHY.¹

THE alphabetic representation of language has long occupied much of my attention, although my efforts hitherto have been directed to means of facilitating the use of orthography as it is, and not to the advocacy of any changes in spelling. The funda-

¹ From a letter addressed to the House Committee on Printing and to members of Congress and of the Senate, by Alexander Melville Bell, on the scheme of amended orthography recommended by the commission of the Legislature of Pennsylvania.

mental principle of alphabetic writing — namely, a separate letter for every sound, and a single sound for every letter — has been so widely departed from in English orthography that spelling-reformers have not dared to advocate the application of the principle in its perfect and beautiful simplicity, but have contented themselves with attempts to remove the most obvious anomalies in practice.

I should prefer to add at once the necessary radical improvement of new letters for unrepresented sounds; but comparatively few persons seem yet prepared to carry reform to this extent, and therefore the application of a completely phonetic orthography must at present be confined to the initiation of children and of foreign learners of our language. A simplification of general spelling is, however, very desirable, and it is easily practicable by the means recommended by the commission of the Pennsylvania Legislature; namely, by adoption, in the public printing of the United States, of the Joint Rules for Amended Spelling, which have been approved by the Philological Society of London and the American Philological Association.

With your permission, I shall state briefly some of the chief recommendations of the simplified spelling proposed in these rules.

First, Economy of time. About one-half of the time now spent in learning to read will be saved by simplified spelling. Phonetic initiatory systems have been largely tested during a number of years, and the result has uniformly been a saving of not less than fifty per cent in the time required to make good readers.

Second, Economy in printing. In the report of the Pennsylvania commission, made in April, 1889, the saving in expenditure for paper and printing, from the use of simplified spelling, is calculated at seventeen per cent. I have tested this computation by comparing the number of letters in some pages of 'World-English' and of ordinary typography; and I find a difference in favor of the phonetic letters of one in seven, or a little over fourteen per cent in the number of types. Adding the values of labor and paper, this calculation will amount to very nearly the same as that in the report. This economy cannot be considered unimportant, when we reflect that we now waste nearly one column in six in our newspapers, one page in six in our magazines, and one volume in six in all our works of literature. In hand-writing and type-writing, also, for every six letters that we really require, we have the trouble of writing at least seven.

Third, Rationality in teaching. The want of correspondence between letters and sounds stultifies children, and hinders the development of the reasoning faculty in education. We might as well allow a fluctuating value to the numerals 1, 2, 3, etc., as to the alphabetic letters. If *e+a* may sometimes sound *ē* (read), sometimes *ā* (great), sometimes *ē* (head), and sometimes *ah* (heart), why may not 1+2 be sometimes equal to 1, sometimes to 2, sometimes to 3, and other times to 6? The mental confusion in the learner would not be greater in the one case than in the other; and the latter case is not merely supposititious, but, unfortunately, real and existent. In phonetic spelling the learner pleasantly recognizes the truth of relationship between letters and sounds, whereas in common orthography he is painfully aware of the falseness of the pretended relation. He is thus taught a life-lasting lesson of truth or of falsehood in the very beginning of education.

Fourth, Simplicity and practicability. The scheme proposed has the sufficient recommendation of approval by the English and American Philological Societies. As an instalment of spelling-reform, it is entirely unobjectionable, and it will undoubtedly effect a large part of the advantages of a more phonetic system. Every change consists in reduction of the number of letters used in spelling: consequently the plan is altogether a simplification of the method of representation. We who can use the old cumbrous orthography have nothing to learn in connection with the new scheme: we have only to dispense with superfluities.

Fifth, Ultimate perfectibility. A scientific scheme would

necessarily include new letters for unrepresented sounds. The introduction of these is not contemplated in the present movement, but is left to the action of those who will, under phonetic training, be more and more free from existing "orthographic" prejudices. The scheme indorsed by the philological societies will facilitate the removal, in time, of all remaining anomalies; while it will not create difficulties to stand in the way of future improvements. What we do now within the prescribed limits, will not require to be undone at any time hereafter.

Sixth, Justice to the young. Children are condemned to a positive wrong when they are unnecessarily subjected to a long and severe task in order simply to acquire the use of the instrument of learning. The helplessness of the victims of this wrong should be one chief recommendation of such a measure of redress as that which is now proposed. The time saved in learning to read will be so much added to that for acquisition of knowledge. Teachers and learners will be alike benefited and elevated by the elimination of so much of mere drudgery, and the addition of so much valuable opportunity for profitable study. Brighter and more intelligent pupils will rise to higher standards in the common schools, and every department of education will participate in the advantages begun with learners of the A B C.

Such considerations as are here briefly presented should not require the addition of a single word to induce all but those predetermined against any change to favor the adoption in the public printing of the nation of the proposed scheme of amended orthography.

A short time would suffice to test the influence of this example on general practice. The conductors of the periodical press will not be slow to adopt the changes if these shall be widely approved by the public. At the same time, adoption or rejection will be equally voluntary. The old orthography will remain as legible as it is now; and the vast capital invested in permanent literature will lose none of its present value.

I have spoken of this plan of amended spelling as only an instalment of what is due to our language. To attempt more as a beginning, might be impolitic; to do less would be worthless.

The substance of the rules embraced in the recommendation before you might be expressed in a single sentence; namely, omit all silent and phonetically dispensable letters. This principle would cover every change included in the twenty-four rules.

I cannot refrain from adding that observance of these rules ought to have prevented such a manifest inconsistency as is exhibited by the Spelling-Reform League in dropping *u* from the combination *ou* in *favour*, *harbour*, *valour*; and dropping *o* from the same combination, with the very same sound, in *nourish*, *journey*, *double*. Every change should be a step in a strictly phonetic direction, or it had better not be made. The rule in the 'Report of the Pennsylvania Commission' (p. 36, No. 7) is phonetically right: the League's concomitant to it (p. 37, No. 1) is phonetically wrong. The limits prescribed by the rules must be observed with exactness, or the latter can no longer be called the rules indorsed by the philological societies. This action of the Spelling-Reform League seems to show the same principle at work which has frustrated all previous attempts at amended orthography; namely, prejudice in favor of what is already in use. In a question between the right and the wrong use of letters, such a consideration should have no place.

This is not a subject respecting which enthusiastic advocacy or passionate discussion can be roused. Those who are called to act will be themselves unaffected by the result, for we have passed the stage when the right use of letters was a trouble to us. May we never reach the stage when the difficulties of beginners shall cease to excite our sympathy and inspire our efforts!

The one impediment to the changes which we seek to accomplish — and which reason, right feeling, and policy demand — is simply that of prejudice. We are accustomed to the pres-

ent aspect of words: they serve our purpose very well as they are, and we are inclined to deprecate any alteration, lest it might give a foreign or a mutilated look to what is now familiar and symmetrical to our eye. We should not think of ourselves at all in this matter, but think only of the helpless juvenile throng who crowd into the places which we vacated years and years ago. Simplify spelling for the sake of the little ones who must suffer from our neglect.

One other point calls for notice; namely, the moderate character of the present proposal. The full amount of change that can result from this measure of simplified spelling is but a small part of what is necessary to make the writing of our language phonetic. We shall still have to use double letters for single sounds in a large proportion of both vowels and consonants, and to tolerate many irregularities in such compounds. In fact, the utility of a purely phonetic initiatory method, such as that of "World-English," will be still almost as marked as it is now.

Why, then, advocate this measure? Because it is a step in the right direction, and step by step is the best mode of making progress. There is more to be done than can be effected by one impulse, and improvements once commenced will be carried farther and farther by succeeding generations. Our language is apparently destined to spread over the world. It is worthy of the most perfect vehicle of communication that skill can devise. If we cannot complete the work, we can at least help it on, and leave it one stage more advanced than we found it.

Something must be done. Our spelling is a disgrace. Responsibility for its lawless condition attaches nowhere in particular, but rests everywhere. The burden of this responsibility should be laid on some accountable official empowered to consider and inaugurate improvements. In the absence of any such delegated authority, the direct action of the representatives of the people is invoked, not to impose changes on the unwilling or the indifferent, but only to exemplify, and by example to invite adoption of the method of improvement recommended by competent advisers.

Private efforts have already been most liberally devoted to the work of amending orthography; but no private efforts can be made on the scale, or with the influence, of a measure emanating from Congress. Besides, this work is peculiarly of public and not of private benefit. It must be done by you, or else it must remain unaccomplished.

HEALTH MATTERS.

The Bacteriology of Whooping-Cough.

At the third general meeting of Russian medical men at St. Petersburg, Professor Afanasieff read an able and exhaustive bacteriological essay on the subject of pertussis. At the suggestion of Professor Afanasieff, who was anxious to verify his results, Dr. Semtchenko took up the line to further investigate the matter, especially in clinical regards. The conclusions arrived at by the Kazan pædiatrist, says the *London Medical Recorder*, may be given thus: 1. Afanasieff's bacterium is actually specific, and hence fully entitled to bear the name of the *bacillus tussis convulsivæ*; 2. The micro-organism makes its appearance in the sputum during the catarrhal stage, somewhere about the fourth day of the disease, but possibly still earlier; 3. Subsequently its numerical strength increases, the intensity of paroxysms keeping pace with the increase; 4. The microbes disappear from the discharge, apparently somewhat before a complete cessation of whoops (about the time when the number of paroxysms sinks down to four or two per day); 5. As soon as pertussis becomes complicated with catarrhal pneumonia, the bacilli in the patient's sputa show an enormous increase in number; 6. Altogether, the pertussis pneumonia seems to be quite different from other varieties of pulmonary inflammation; 7. The *bacillus tussis convulsivæ* presents a great importance not only in etiological and diagnostic, but also in prognostic regards; 8. As to the behavior of the microbe toward antiseptic agents, its vitality is destroyed as soon as

the medium (jelly) contains corrosive sublimate in the proportion of 1 to 60,000, or resorcin in that of 1 to 1,200, or phenol in the same one, or hydrochlorate of quinine in that of 1 to 800. Drs. Afanasieff's and Semtchenko's researches were repeated (at least partially) by Professor Tschamer (*Wiener med. Wochens.*, No. 17, 1888) and Dr. E. C. Wendt of New York (*Medical News*, June 2, 1888). On the whole, both of the authors confirmed the statements made by the Russian observers. Dr. Wendt, however, differs from Dr. Semtchenko in some more or less subordinate points. Thus, he could not detect the presence of the bacilli in earlier stages of the affection; neither was he able to notice any co-relation between the number of paroxysms and that of the bacteria in the patient's sputa; while, on the other hand, he found still the bacilli in the discharge, even after a complete disappearance of whoops. In conclusion, Professor Afanasieff draws attention to the several points which demand further elaborate investigations. It is necessary, he says, (1) to more closely examine the distribution of the microbes in the respiratory mucous membrane, as well as in broncho-pneumonic foci; (2) to study the behavior of the bacterium toward various coloring-matters (in order to discover a characteristic differential test for the bacillus); (3) to study the spore-formation (which is important, especially in prophylactic regards); (4) to most carefully inquire into a clinical bacteriology of the pertussis sputa from the beginning to the end of the attack, and even during convalescence (which is important for diagnostic, prognostic, and prophylactic purposes); and (5) to further study the behavior of the bacillus toward all possible parasiticide agents (to possibly discover some specific bactericidal substances, which discovery would prove of untold value in regard to the therapeutics of the infantile scourge in question).

[Sea-Water and the Nutrition of Marine Animals.

Drs. Pouchet and Chabry have recently conducted some experiments of great biological interest. They have reared larval germs of sea-urchins in artificial sea-water and in sea-water deprived of all or more or less of its lime, in order to observe the influence of the composition of the water on the development of the larvæ. Normally a distinct skeleton should develop. According to the *British Medical Journal*, it was found, that, when the larvæ were reared in sea-water deprived of about nine-tenths of its lime, not even a rudimentary skeleton was developed. A very trifling diminution in the normal amount of lime, effected by careful precipitation by chemical re-agents, was found sufficient to interfere markedly with the growth of the skeleton in the larvæ: hence the medium in which some marine germs of life exist would appear to act as a nutritive agent as well as an atmosphere whence oxygen may be obtained for respiration. The influence of the chemical composition of the water in different seas probably determines many differences in the anatomy of marine animals, but Drs. Pouchet and Chabry admit that this question requires much consideration. How far the embryo in the higher terrestrial forms of life may receive nutrition direct from substances in solution in the *liquor amnii*, as well as through the placental circulation, is another question worth solving.

NOTES AND NEWS.

PROFESSOR C. S. PLUMB of Knoxville, Tenn., has accepted the position of vice-director of the Agricultural Experiment Station of Purdue University, Lafayette, Ind., and after the 1st of April next his address will be at the latter place.

— At a recent meeting of the Paris Geographical Society, as we learn from *Nature*, an interesting lecture was delivered by Dr. Hamy on the history of scientific missions in France under the old monarchy. He commenced practically with the reign of Francis I., and described many missions abroad, with purely scientific aims, which are now either forgotten, or the results of which have never been published. Thus, the apothecary to Henri IV. went all over the globe in search of the peculiar products of each country, especially medicinal and food plants; still earlier,